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A REVIEW OF THE AMERICAN GENERA AND SPECIES OF MULLIDÆ.

BY EDWARD A. HALL AND J. Z. A. MCCAUGHAN.

In the present paper we have attempted to collect the synonymy of all the American genera and species of the family of Mullidæ. All the specimens examined by us belong to the Museum of the Indiana University.

Analysis of American Genera of Mullidæ.

- a. Teeth on lower jaw, vomer and palatines; upper jaw toothless; caudal lobes equal. Vertebrae 9 + 14; the nasal bone, which forms a downward hook over maxillary, strongly developed; interorbital space flat and wide; opercle without spine. D. VII-I, 8; A. II, 6. MULLUS. 1.
- aa. Teeth on both jaws; vomer and palatines toothless. Vertebrae 9 + 14; the nasal bone, which forms a downward hook over the maxillary, moderately developed; interorbital space concave and narrow; opercle ending in a single spine. UPENEUS. 2.

1. MULLUS.

Mullus Linnæus, Syst. Nat., 1758, ed. 10, 299 (*barbatus*; *surmuletus*).

The species of this genus, two or three in number, are very closely related. They are chiefly confined to the waters of Europe.

Analysis of Species of Mullus.

- a. Depth less than 4 in length; maxillary scarcely reaching front of orbit; eye much larger than in *M. surmuletus*, less than 5 in head; barbels scarcely reaching to lower angle of preopercle, more than $1\frac{1}{3}$ in head. Scales more deciduous than in *M. surmuletus*. (*Vinciguerra*.) *barbatus*.¹

¹ For purposes of comparison we insert the characters of this European species as given by Vinciguerra. We have examined no specimens of it. The descriptions given by Günther and others, of *M. surmuletus* and *M. barbatus*, are said to show a confusion of the two forms.

- aa.* Length of head greater than depth of body, $3\frac{1}{4}$ in length of body; depth 4 in length; snout $7\frac{1}{7}$ in length of body; maxillary not quite reaching the vertical from front of eye; eye 5 in head; interorbital space $12\frac{1}{2}$ in length of body; barbels reaching to a point half-way between angle of preopercle and extremity of opercle, $1\frac{1}{3}$ in head. Sides of body with three yellow longitudinal stripes; first dorsal barred with light and black. *surmuletus*. 1.
- aaa.* Length of head about equal to depth of body, about $3\frac{3}{4}$ in length of body; snout $7\frac{6}{10}$ in length of body; maxillary just reaching vertical from front of eye; eye 4 in head; interorbital space $14\frac{7}{8}$ in length of body; barbels reaching to extremity of opercle, $1\frac{1}{3}$ in head; scales in lateral line 32. Sides of body with two yellow longitudinal stripes; first dorsal with an orange band at base and a yellow one higher up; second dorsal mottled with scarlet and pale; no black on dorsals. *surmuletus auratus*. 1 (b).

1. *Mullus surmuletus*.

(*a.*) Var. *surmuletus*.

Trigla capite glabro, lineis utunque quatuor, luteis longitudinalibus parallelis Artedi, Ichthyol., 1738, 43 (Mediterranean Sea; Ocean by Cornwall).

Mullus surmuletus Linnæus, Syst. Nat., 1758, ed. 10, 300 (Mediterranean); Linnæus, Syst. Nat., 1766, ed. 12, 496 (Mediterranean); Brunich, Ichthyol. Massiliensis, 1768, 72 (Marseilles); Pennant, "Brit. Zool., iii, 1769, 368, pl. 64"; Bloch, Ichthyologia, Taf. 57, 1785; Bonnature, "Ichthyol, 1790, 144, pl. 59, fig. 233"; Linnæus, "Fauna, Suec. ed. Retz, 1800, 341"; Shaw, "Brit. Zool., iv, 1800, 1819, 613, pl. 88"; Bloch & Schneider, Syst. Ichthyol., 1801, 77, Taf. 18; Donovan, "Brit. Fish., i, 1801, pl. 12"; Turton, "Brit. Zool., 1807, 102"; Risso, Ichthyol. de Nice, 1810, 215 (Nice); Martens, "Reise nach Venedig, ii, 1824, 427" (Venice); Fleming, "Brit. An., 1828, 216"; Cuvier & Valenciennes, Hist. Nat. Poiss, iii, 1829, 433 (Marseilles; Ivica; Nice; Naples); Cuvier, Règne Animal, ed. ii, 1829.

Mullus surmuletus Lacépède, Poiss., v, 1832, 75 (Mediterranean, Baltic, Atlantic Ocean); Jenyns, "Manual Brit. Vert., 1835, 337"; Yarrell, "Brit. Fishes, i, 1841, 31"; Guichenot, Explor. Sci. Alger. Poiss., 1850, 38 (Algiers); White, "Cat. Brit. Fish., 1851, 14"; Thompson, "Nat. Hist. Ireland, iv, 1856, 70" (Ireland); Günther, Cat. Fish. Brit. Mus., i, 1859, 401 (Brixham; British Channel; Medeira, Mediterranean; Dalmatia); Couch, "Fish. Brit. Isles, i, 1862, 208, pl.

- 47''; Collet, Norges Fiske, 1875, 17 (Christianafjord; Lindesnaes; Bergen); Bean, Proc. U. S. Nat. Mus., 1879, 26 (Europe); Vinciguerra, Risult. Ittiol. del Violante, 1883, 41 (Dalmazia; Marcova, Melida; Curzola; Lissa; Lagosta and Cazza).
Mullus barbatus De la Roche, "Ann. Mus. xiii, 1809, 306''; Gronow, Cat. Fish. 1854, 108; Steindachner, Uebersicht Meeresfische an Küsten Spaniens und Portugals, 1867, 33 (Cadiz; Lisbon; Gibraltar; Teneriffe); Botteri, Cat. Pesci di Lesina, 1873, 60 (Lesina).
Mullus barbatus surmuletus Day, Fishes of Great Brit., 1880, 22, pl. 8, fig. 2 (Mevagissey).
Mullus dubius Malm, "Ofversigt of Kongl. Vet. Akad. Forhandl., 1852, 224'' (Sweden).

(b.) Var. *auratus*.

- Mullus barbatus auratus* Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 280 (Pensacola); Jordan & Gilbert, Syn. Fish. N. A., 1882, 931 (Pensacola; Wood's Holl).
Mullus auratus Jordan Proc. U. S. Nat. Mus., 1884, 39 (Pensacola).

Habitat.—Var. *surmuletus*, on all southern and western coasts of Europe, from Sweden to Africa; the most common species in most parts of Europe. Var. *auratus*, eastern coast of America, Wood's Holl to Pensacola.

This form called *auratus*, has been occasionally taken on our Atlantic and Gulf coasts, but it is evidently rare. The single specimen examined by us came from deep water at Pensacola. It seems to us to be a variety of *M. surmuletus* rather than a distinct species, and it is certainly nearer *M. surmuletus* than *M. barbatus*, as the latter is described.

Many European writers have denied the distinctness of *M. surmuletus* and *M. barbatus*. The following account of the two, translated from Vinciguerra's Risultati Ittiologici del Crociere del Violante, seems to give a final answer to the question as to the difference between these two species.

"No one of the Mediterranean ichthyologists has yet been willing to accept the fusion of these two forms, an opinion which I regard as really incorrect, and caused by the scarcity of *M. barbatus* in the waters of the Atlantic and Baltic. I have been able to verify, on an extensive series of examples, that in *barbatus*, as in *surmuletus*, there exist two forms; the one with the profile oblique, the other with the profile rectilinear. These probably represent the two sexes, and those who wish to take as

a differential character the form of the head are thus easily led into error. The real differences which exist between *surmuletus* and *barbatus*, besides that of coloration, are the following: In *M. surmuletus*, the diameter of the eye is much smaller, and the barbels are more robust and longer, reaching beyond the lower angle of the opercle (in *barbatus* they scarcely reach this point), and the body is notably deeper. To these characters may be added the greater adherence of the scales in *surmuletus*, while in *barbatus* these are readily deciduous, and only in extraordinary cases is a specimen found possessing a single scale. In every market on the coast of the Mediterranean the fishermen distinguish between the two species by different names, according to their coloration, relative length of barbels and the place where they live by preference; inasmuch as *surmuletus* is found most readily in rocky places (and hence the common name 'Triglia di Scoglia'), and *barbatus* is found in muddy places (and hence the common name 'Triglia di Fango')."

2. UPENEUS.

Upeneus Cuvier, Règne Animal, ed. 2, 1829 (*vittatus*; *russelli*; *bifasciatus*; *trifasciatus*).

Hypeneus Agassiz, Nom. Zool., Index Universalis, 1846, 190 (amended orthography).

Mulloides Bleeker, "Ceram II, 697, 1852-65 (*flavolineatus*)."

Pseudupeneus Bleeker, Poiss. Côte de Guinée, 1862, 56 (*prayensis*).

Parupeneus Bleeker, Notice sur le *Parupeneus bifasciatus* de l'Ile de la Reunion, 1867, 345 (*bifasciatus*).

Mulhypeus Poey, Syn., 1868, 307 (*maculatus*).

We include under the head of *Upeneus* all the *Mullidæ* having teeth on both jaws and none on the vomer. The variations in the size and number of the teeth seem to us of minor importance.

Analysis of Species of Upeneus.

- a. Teeth on under jaw uniserial, on upper jaw uniserial or occasionally irregularly biserial with the outer teeth turned outward; all the teeth coarse and distinct; maxillary $2\frac{3}{4}$ in head, not reaching vertical from front of eye by one-half of its length; barbels extending to a point half-way between the vertical of preopercle and extremity of opercular spine, $1\frac{1}{2}$ in length of head; eye 4 in head; scales in lateral line

31; depth, 4 in length; dorsal VIII-I, 8; anal, II, 6. Color in spirits, steel-blue above, descending on sides in three blotches; one above point of opercular spine, sometimes extending on opercle; one under each dorsal fin. Under-parts of body pale. *maculatus*. 2.

aa. Teeth of upper jaw uniserial, of lower biserial; teeth rather strong, weaker than in *U. grandisquamis*; barbels extending nearly to vertical of preopercle; eye large, 3 in head; scales in lateral line, 37; depth about $5\frac{5}{9}$ in total length, $4\frac{1}{3}$ in length. Dorsal VII-I, 7; anal I, 5 or 6. Color, bright pink or rose, with broad red band extending from eye to caudal and suffusing caudal (*Gill*). *dentatus*. 3

aaa. Teeth on both jaws in more than one series.

b. Teeth on anterior part of jaws in two irregular series; lateral teeth on jaws in a single series; all the teeth obtusely conical and distinct from each other; teeth on upper jaw turned inwards; barbels extending to vertical of preopercle, $1\frac{1}{2}$ in length of head; eye $3\frac{1}{3}$ in length of head; scales in lateral line 39; depth 4 in length. Dorsal VIII-I, 8; anal II, 6. "Color in life, flesh-color above, sides silvery, tinged with yellow below; a bright yellow band from eye to base of caudal; a whitish streak above and below this; another above lateral line; both dorsals and caudals bright yellow." *Martinicus*. 4.

bb. Teeth on anterior part of jaws in two series; the outer series of the upper jaw being formed by very obtuse and partly confluent teeth. Barbels extending to vertical from root of pectoral fins; eye 4 in head; scales in lateral line 32; dorsal VIII-I, 8; anal I, 6. Color light greenish brown above, rose-color below lateral line; scales with indistinct pearly spot at centre; black blotch on lateral line behind spinous dorsal; a smaller, sometimes indistinct black spot behind orbit; dorsal fins with spots the color of the back; other fins immaculate.

grandisquamis. 5.

2. *Upeneus maculatus*.

Mullus maculatus Bloch, "Ichthyol. about 1790, Taf. 348 (Brazil);" Lacépède, Poiss., iii, 1798-1803, 403 (West Indies; Brazil).

Mullus surmuletus var. *maculatus* Bloch & Schneider, Systema Ichthyol., 1801, 78 (Brazil).

Upeneus maculatus Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, 478 (Martinique; Brazil); Storer, "Syn. Fish. N. A., 1846, 48;" Poey, Mem. Pisc. Cuba, i, 1851, 223 (Martinique; Brazil); Castelnau, "Anim. nouv. ou rares Amer. Sud, 1850-61, 6 (South America); Günther, Cat. Fish. Brit. Mus., i, 1859, 408 (Atlantic coasts of Tropical America; Jamaica); Cope, Trans. Amer. Phil. Soc., 1870, 471 (St. Croix); Jordan & Gilbert, Syn. Fish. N. A., 1882, 565; Jordan, Proc. U. S. Nat. Mus., 1884, 129 (Key West).

Multhypeneus maculatus Poey, Syn., 1868, 307 (Cuba).

Multhypeneus maculatus Poey, Enum. Pisc. Cuba, 1875, 34 (Havana; Jamaica).

Hypeneus maculatus Goode, Bull. U. S. Nat. Mus., v, 1876, 49 (no specimen).

Upeneus punctatus Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, 482 (Mexico); Kner, Novara Fische, 1857-59, 71 (Rio Janeiro); Cope, Trans. Amer. Phil. Soc., 1870, 471 (St. Kitts).

Habitat.—Atlantic coasts of Tropical America, from Key West to Rio Janeiro.

The specimens of this species examined by us are from Key West and Havana.

3. *Upeneus dentatus*.

Upeneus dentatus Gill, Proc. Acad. Nat. Sci. Phila., 1862, 256 (Cape San Lucas); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 363 (Cape San Lucas).

Habitat.—Pacific coast of Tropical America; Lower California.

This species is known to us only from the description of Gill, and the notes of Jordan and Gilbert on Gill's original types.

4. *Upeneus martinicus*.

Upeneus martinicus Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, 483 (Martinique).

Upeneus balteatus Cuvier & Valenciennes, Hist., Nat. Poiss., iii, 1829, 484 (Cuba); Poey, Mem. Cuba, i, 1851, 224 (Cuba); Jordan, Proc. U. S. Nat. Mus., 1884, 129 (Key West).

Mulloidēs balteatus Cope, Trans. Amer. Phil. Soc., 1870, 471 (St. Kitts).

Upeneus flavovittatus Poey, Mem. Cuba, i, 1851, 225 (Cuba).

Mulloidēs flavovittatus Günther, Cat. Fish. Brit. Mus., i, 1859, 403 (Caribbean Sea; Jamaica; Cuba).

Upeneus parvus Poey, Mem. Cuba, i, 1859, 225 (Cuba).

The specimens of this species examined by us are from Key West and Havana. Poey has identified his *flavovittatus* and *parvus* with the *balteatus* of Cuvier and Valenciennes. There seems to be little room for doubt that the scanty description of *martinicus* refers to this species also.

5. *Upeneus grandisquamis*.

Upeneus grandisquamis Gill, Proc. Acad. Nat. Sci. Phila., 1863, 168 (West coast Central America); Günther, Fish. Central America, 1864, 420 (copied from Gill); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 626 (no description); Steindachner, Ichthy. Beiträge, iv, 1875, 6 (Panama).

Upeneus tetraspilus Günther, "Proc. Zool. Soc., 1864, 148;" Günther, Fish. Central America, 1864, 420, Pl. 66, fig. 1 (Panama).

Habitat.—Pacific coast of Tropical America; Panama.

This species is known to us only from the descriptions of Gill, Günther, and Steindachner. Professor Jordan tells us that the *Upeneus tetraspilus* of Günther is certainly the same as the *Upeneus grandisquamis* of Gill.

[We regret to announce that while this paper was going through the press, one of the authors, Mr. EDWARD ALLEN HALL, was drowned in Salt Creek, about eleven miles from Bloomington, Ind., on May 22, 1885. He was born at Rushville, Ind., January 9, 1864, and had, during his course of study at the State University of Indiana, proven himself to be an energetic and faithful student.—E. J. N.]